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by the great advances made in the apparatus both for attack and for defence in recent years. The absurd inadequacy of most if not all of our present fortifications is pointed out; for those of them that were erected about 1812 had only to withstand a 42-pound projectile fired with a muzzle energy of 800 foot-tons by a 10-pound charge of powder, and those built at the outbreak of the rebellion had only to withstand a 450-pound projectile fired with a muzzle energy of 9,000 foot-tons by a 130-pound charge of powder. The 16-inch rifle of 1896, which is 45 feet 6 inches long, weighs 115 tons, and fires a projectile weighing 2,300 pounds with a muzzle energy of 55,000 foot-tons by the explosion of 800 pounds of powder, would make short work of the best of them. The bombardment of Alexandria in 1882 is cited as an instance of what might quite readily happen to us. The defences of Alexandria were quite similar to ours, and their armament far superior to any that we have; yet eight English ironclads made their evacuation necessary after one day's bombardment.

Our forts, excellent during the masonry and earthen ages, have never been replaced in the iron age. On the other hand, twenty-eight of the Gruson cast-iron cupolas, which have been found efficient against the heaviest projectile, have been constructed in the harbors of Germany, Austria, Belgium, and Holland within a few years. Lieutenant Griffin's treatment of modern seacoast defences is very thorough, and, we should fancy, authoritative. He appends to his article a very valuable table, showing the name, age, displacement, draught, speed, class, thickness of armor and style of armament, of every foreign vessel available for offensive operations against the United States. The list is most imposing, and includes 71 English ships, 50 French, 14 German, 24 Russian, 19 Italian, 15 Turkish, 13 Austrian, 7 Danish, 7 Dutch, 5 Spanish, 6 Brazilian, 3 Japanese, and 3 Chilean. In the face of all this, "since 1875 not one penny has been appropriated for the construction of seacoast defences. The annual appropriation of \$100,000 for preservation and repairs, increased to \$175,000 since 1881, has not even sufficed to preserve our unfinished works, and our defences are actually in a worse condition to-day than they were ten years ago."

METEOROLOGY IN CALIFORNIA.

THE ninth biennial report of the California state board of health (Sacramento, 1886) contains, besides much immediately pertinent to its office, several valuable descriptions and tables concerning meteorological data, which the members of

the board wisely deem of importance in their professional studies. First in value is a long table of monthly rainfall, both for the past year and for the mean of several years, compiled by Lieut. W. A. Glassford, in charge of the Pacific coast division of the signal service. This is similar to the newspaper list prepared by the same officer, to which reference was lately made in *Science*, but it is here presented in more extended and convenient form. The weak spot in this table is the absence of any indication that the numerous stations possess good gauges, uniformly placed and well observed. On account of the difficulty in identifying the position of many of the stations, it would be of much service to readers at a distance if such a table as this could be reduced to graphic form in a series of monthly maps. They would necessarily be only provisional for the present, as some records are much shorter than others, so that the means are not properly comparable; but even these values would doubtless present a truer picture of west-coast precipitation than any yet prepared. It is to be hoped that similar tables and diagrams of temperature means may also be attempted.

Sergt. J. A. Barwick of the Sacramento signal office contributes a review of the meteorological conditions of his city for the past year, and a table of its temperature and rainfall since 1853 and 1849 from records early established by Drs. Logan and Hatch. The mean seasonal temperatures for 33 years are, spring, 59°.5; summer, 71°.7; autumn, 61°.5; winter, 48°.3; for the year, 60°.2. The extremes of the mean annual are 57°.5 (1880) and 62°.8 (1864). The absolute maxima rise to 103° or 105° in July and August, and the minima fall to 21° or 22° in January or February. The mean annual rainfall for 38 years is 19".64, varying from 8.44 (1877) to 34.92 (1844): the mean for July is 0".03; August, 0.003; December, 4.65; January, 3.84; February, 2.80; March, 2.91; counting the years by seasons, from July to June inclusive, the annual amounts range from 4.71 (1850-51) and 7.79 (1863-64) to 36.00 or a little more (1849-50, 1852-53, 1861-62). These pronounced contrasts of seasonal fall and great variations in the annual total show how completely unlike the western coast climate is the eastern and central. Sergeant Barwick presents also brief monthly notes of significant features, all of interest and value, but easily increased in both respects if the phenomena described were viewed in a broader way, from a more physical and less statistical stand-point. Annual and monthly averages show general planetary or continental relations; monthly extremes usually result from cyclonic disturbances, and should be stated in connection

with their transitory causes; diurnal variations, when not controlled or destroyed by importation of external conditions in the winds of strong gradients, are always significant of local geographic surroundings, and cannot be too closely examined for every separate station. Such local characteristics are, without doubt, known to many of our signal-service observers, but they have not often found their way into print. The annual reports of the chief signal officer hardly have room for them; the regrettable cessation of the 'signal-service notes' withdraws a fitting medium for their publication; scientific journals and local health or engineering reports may well open their pages to such material, when adequately prepared.

Three general papers should also be mentioned, — 'The climatology and diseases of southern California,' by H. S. Orme, M.D., of Los Angeles, president state board of health; 'Report on the . . . climatology . . . of Surprise and Goose Lake valleys,' by Dr. G. M. Kober, U. S. A., stationed at Fort Bidwell; and 'The coast climate of California,' by J. W. Robinson, M.D., of Crescent City. Dr. Orme mentions the pronounced control of the sea-breeze over the coast temperatures. During hot days, when thermometers in the interior rise to 115° to 125°, a stiff sea-breeze blows inland all along the southern coast, and prevents the littoral temperature from rising over 90°. He briefly mentions also a hot and dry wind, usually confined to limited localities a few miles inland, and frequently issuing from the Santa Ana pass in the Coast range, whence it takes its name. This is of particular interest, as it suggests the physical identity of the wind with the Foehn of Switzerland; and further details of its occurrence will therefore be impatiently awaited by those who are already tired of having to quote so largely from foreign sources for illustration of phenomena that certainly only need intelligent and discriminating observation for their discovery in our own country. The same expectation is raised by Dr. Kober's brief report on Surprise valley, — a flat depression in the north-eastern corner of the state, sixty miles north and south by eight east and west, with elevation of 4,600 feet, enclosed by an ascending barren plateau on the east, and separated from Goose Lake valley on the west by the Warner range, 6,000 to 8,000 feet high. The valley is well described in its geological relations by Russell in the 'Fourth annual report of the geological survey,' and shown to be the dried bed of an old lake, whose highest shore-line forms a conspicuous feature on the valley slopes, 550 feet above the present shallow alkaline lakes on the valley floor. Dr. Kober's figures give a characteristic great

diurnal range of temperature, not uncommonly amounting to 50°; a relative humidity of 83 per cent in November, 1885, January and February, 1886, when 9".09 of the total 19".15 of precipitation occurs, according to a twenty-year record, contrasting strongly with the nearly absolute dryness of the summer: in September, 1885, the mean relative humidity was only 24.1 per cent, with a mean temperature of 64°. The winds show two diurnal maxima, indicating local control of their flow, — a west wind from the Warner range, with highest velocity shortly after midnight; and a southerly wind from the centre of the valley basin towards the high northern divide, with greatest strength just after noon. These directions clearly indicate the rhythmical flow of the cool, mountain, down-cast wind at night, and the warm, valley, up-cast wind by day. Winds of the Foehn species — commonly known in the north-west as the Chinook — ought to be felt here with much distinctness; and a comparison of records at Fort Bidwell, in Surprise valley, with others at some of the settlements in Goose Lake valley, on the western side of the Warner range, would doubtless lead to their accurate definition.

Dr. Robinson's paper is of especial value in its desire to discriminate between the good and poor records of the various coast stations. We fear that his criticism on observations at military posts may be only too just. These observations are in many cases merely perfunctory, in obedience to orders from headquarters, and are here described as too often made, not by the post-surgeon, but by the hospital steward, "who, from the recesses of his inner consciousness, draws up a report that reads well, but which has not the slightest foundation in fact." But in other cases great differences appear in neighboring records, where both observers are conscientious and painstaking; so that the variation must be laid, as it commonly may well be, to the instruments and their exposures. For example: Crescent City, on the coast, in latitude 42°, has two gauges: one is a five-inch square gauge, placed near the shore, at low level, and in line with a depression that leads an indraught of rainy winds from the sea; the other is a two-inch circular gauge, half a mile away at the lighthouse on a promontory, sixty feet over the ocean. From September, 1885, to May, 1886, inclusive, the first gauge collected 105".28, and the second only 57".69. Along with critical comparisons such as these, we regret to see the author's belief in the forest-control of rainfall. Rain-records have not yet been quoted in sufficient confirmation of this unwarranted conclusion; and even here we read, in regard to Crescent City, that the rainfall has diminished,

but "how much it is difficult to say, as observations conflict." Dr. Robinson also makes interesting reference to the winds of the coast, and describes the west winds of summer as greatly intensified by the (diurnal) heat of the interior valley, so that the sea-breeze is unusually strong over the passes that break down the elevation of the Coast range.

It is greatly to be wished that further detail should be presented of facts so interesting in themselves and so valuable in the physical description of our country. The suggestion made above concerning the cyclonic and local control of the weather elements is, it is believed, in a most profitable line for further work. Examples of similar weather-types, as indicated by recurrence of similar distribution of isobaric lines on the signal-office daily maps, should be brought together and discussed in search of their specific characteristics, instead of lost in the indiscriminate average of the monthly mean, itself of true value, but too often the end instead of the first step of the discussion. Local controls are found to prevail during anticyclonic weather, with high pressure and weak baric gradients: imported conditions appear with the approach and passage of cyclonic areas of low pressure and stronger gradients. Here is a wide field for observation and research.

W. M. D.

CONSUMPTION IN PENNSYLVANIA.

THE *New York medical journal* of Dec. 4 contains in full the exceedingly valuable contribution to the climatological study of consumption in Pennsylvania, by William Pepper, M.D., which was read at the third annual meeting of the American climatological association. In the inquiry which formed the basis of this paper, Dr. Pepper followed the plan adopted by Dr. Bowditch in investigating the same disease in Massachusetts in the years 1854-62. Dr. Bowditch, it will be remembered, found a law in the development of consumption in that state, which has for its central idea that the dampness of the soil of any township or locality is intimately connected with, and probably a cause of, the prevalence of consumption in that township or locality. Similar investigations, especially those of Dr. Buchanan in England, which were carried on in 1865, 1866, and 1867, confirm the views of Bowditch. In that country, where the subsoil was drained by sewers, and where the water-supply was improved, deaths from consumption diminished, falling 49 per cent in Salisbury, 47 in Ely, 43 in Rugby, and 41 in Banbury. With answers from physicians to twenty-eight questions propounded in a circular

by Dr. Pepper, and the statistics of the tenth census of the United States, together with the topographical map of Professor Lesley as a basis, maps have been prepared showing the prevalence of consumption in Pennsylvania counties, and the relation between such prevalence and elevation, and mean annual temperature and rainfall. One of these maps is given in the journal referred to: the others will be published in the Transactions of the association. It is noticeable that those portions of the state where phthisis is rarest are the most elevated, having a general altitude of 1,500 to 2,000 feet, from 2,000 to 3,000 feet, and that its mortality increases as the altitude becomes less. In Philadelphia the wards having the least elevation, greatest density of population, and most inferior water-supply, furnish the greatest mortality from phthisis. The answers to the inquiries received from the state at large do not seem to indicate excessive soil moisture as the main causal condition of consumption in the state. A number of individual cases are given, in most of which damp and otherwise unsanitary conditions existed in and around the houses in which repeated cases occurred. This inquiry is a most timely one, as the tendency of the times seems to be to ignore conditions such as are here described, and to account for the disease only by the introduction of the bacilli of Koch. That these are the direct cause but few doubt, though unsanitary surroundings and heredity are important predisposing causes.

THAYER'S GREEK-ENGLISH LEXICON.

THE only special dictionary in the English language hitherto available for students of the Greek New Testament has been a translation of Cremer's 'Biblisch-theologisches wörterbuch der Neutestamentlichen Gräcität.' This is not only very inconvenient in its arrangement, but is justly chargeable with a certain vagueness in its definitions. We think, therefore, that Professor Thayer has rendered an incalculable service to a numerous class of students by opening to them the treasures of German erudition to be found in Grimm's 'Clavis.' But he has done vastly more than this. Almost every page of the noble volume before us shows such signal traces of his critical scholarship, his profound learning, and his conscientious labor, as to make it only a matter of simple justice that the book should bear his name. In regard to the technical and theological aspects of the work, we have neither the desire nor the competence to pronounce an opinion; but, as a

A Greek-English lexicon of the New Testament, being Grimm's Wilke's Clavis Novi Testamenti. Tr. by JOSEPH HENRY THAYER, D.D. New York, Harper, 1887. 4°.